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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/767,102	01/29/2004	Jenc A. Golovchenko	HVD2160	4434

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THERESA A LOBER
T.A. LOBER PATENT SERVICES
45 WALDEN ST
CONCORD, MA 01742

EXAMINER

SINES, BRIAN J

ART UNIT	PAPER NUMBER
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1797

MAIL DATE	DELIVERY MODE
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12/06/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/767,102

Applicant(s)

GOLOVCHENKO ET AL.

Examiner

Brian J. Sines

Art Unit

1797

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 November 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-11 and 22-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-9, 11, 22-28 and 30-32 is/are rejected.
- 7) ☒ Claim(s) 10, 29 and 33-35 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection. The final rejection is withdrawn.

Allowable Subject Matter

The indicated allowability of claims 2 – 8, 22, 24 – 28 and 30 – 32 is withdrawn in view of the reference(s) to Tao. Rejections based on the cited reference(s) follow.

Claims 10, 29 and 33 – 35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 10, the pertinent cited prior art neither teaches nor fairly suggests the further incorporation of wherein the electrically-conducting electrodes are disposed on an electrically insulating membrane including an aperture aligned with the gap between the electrodes.

Regarding claims 33 – 35, the pertinent cited prior art neither teaches nor fairly suggests the further incorporation of the step of using a work function as claimed.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who

has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(e) of this title before the invention thereof by the applicant for patent.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 3 - 5, 9, 11, 23 - 25 and 30 - 32 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Tao et al. (U.S. Pat. No. 7,030,452) ("Tao").

Regarding claims 1, 9, 11, 23 and 30, Tao teaches a method for controlling a gap in an electrically-conducting solid state structure. Tao teaches a method for forming atomic-scale contacts and atomic-scale gaps between two electrodes (see, e.g., Abstract). The disclosed method comprises the steps of:

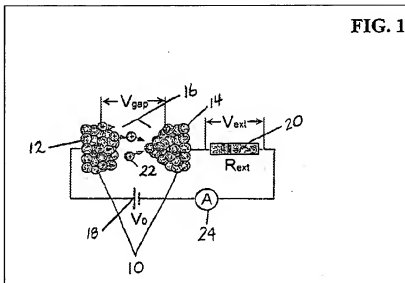
(1) providing an electrically conducting solid substrate including a gap between two electrodes in the structure (see, e.g., col. 7, lines 17 – 26; col. 6, lines 23 – 35);

(2) exposing the structure to a fabrication process that alters an extent of the gap in the structure (see, e.g., col. 6, line 23 – col. 7, line 7);

(3) applying a voltage bias across the gap in the structure (see, e.g., col. 3, line 6 – col. 4, line 39);

(4) measuring the electron tunneling current across the gap to indicate an extent of the gap. Tao indicates that a meter is used to measure tunneling current and thereby indicate an extent of the gap (see, e.g., col. 3, lines 14 – 54; col. 4, lines 4 – 62; col. 6, line 23 – col. 7, line 26); and

(5) controlling the etching and deposition process environment during process environment exposure of the structure, based on the tunneling current measurements to control an extent of the gap (see, e.g., col. 4, lines 4 – 62; col. 6, lines 23 – 63).



Tao teaches that the etching and deposition process is halted or stopped once the desired gap width is formed. The termination process is accomplished by coupling one electrode to resistor 20. Tao teaches that as the gap 16 decreases due to deposition of metal ions 22 on cathode electrode 14, the tunneling current increases between electrodes 10. Eventually, the resistance of gap 16 decreases to less than the resistance of resistor 20 and continues decreasing. As the resistance of gap 16 decreases, the etching and deposition process terminates, as indicated by meter 24 (see, e.g., col. 3, lines 50 – 54; col. 4, lines 4 – 62). Contacts of different sizes and gaps of different widths are formed by varying the magnitude of the resistor in the circuit (see, e.g., col. 4, lines 54 – 62). Consequently, as indicated by Tao, it is inherently anticipated that the process is stopped based upon the tunneling current flowing through the gap. Therefore, Tao anticipates that the process for extending the gap can be controlled based on the tunneling current measurement as claimed.

Alternatively, the applicant is advised that the Supreme Court recently clarified that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp.” An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. The combination of familiar elements is likely to be obvious when it does no

more than yield predictable results. See *KSR Int'l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007).

In this regard, Tao does teach that the tunneling current flowing between the gap 16 is measured and is indicated by meter 24 (see, e.g., col. 4, lines 4 – 62; col. 5, lines 33 – 54; figure 1). Since, as indicated by Tao above, the tunneling current measured is indicative of gap width, it would have been considered obvious to incorporate the tunneling current measurement in controlling the gap formation process (see, e.g., col. 5, lines 33 – 54; col. 6, lines 45 – 54). It is predictable that a certain gap width would be associated with a specific tunneling current measurement. Therefore, it would have been obvious to a person of ordinary skill in the art to stop the deposition process in the formation of the gap based on the tunneling current measurement in order to control the extent or width of the gap as claimed.

Regarding claim 3, since, as indicated by Tao above, the tunneling current measured correlates with gap width, it would have been considered obvious to incorporate the use of a reference tunneling current measurement in controlling the gap formation process. Therefore, it would have been further obvious to a person of ordinary skill in the art to incorporate a step of comparing the tunneling current measurement to a reference or threshold current that corresponds to a prespecified gap extent in order to control the gap formation process.

Regarding claim 4, Tao teaches that an etching process can also occur in the formation of the gap (see, e.g., col. 3, lines 35 – 44). Therefore, it is considered obvious to a person of ordinary skill in the art to consider incorporating a step where the conditions (i.e., applied bias voltage) of the fabrication process environment are selected to increase the extent of the gap.

Regarding claim 5, Tao anticipates that the conditions (i.e., metal ion concentration) of the fabrication process environment are selected to decrease an extent or width of the gap using electrochemical deposition (see, e.g., col. 4, lines 40 – 62).

Regarding claims 24 and 25, the use of electrical contact pads to facilitate electrical connections, such as for connecting to a power source or measurement instrument, within electronic devices is well known in the art. Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of electrical contact pads as claimed.

Regarding claim 31, the use of signal amplification techniques are well known in the art. Therefore, it would have been obvious to a person of ordinary skill in the art to employ the use of an electrical signal amplification for the electron tunneling current in order to facilitate the accurate measurement of the tunneling current.

Regarding claim 32, the use of digitizing techniques in signal measurement is well known in the art.

2. Claims 6 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tao in view of Iwamatsu (U.S. Pat. No. 5,071,832) (“Iwamatsu”).

Regarding claim 6, Tao does not specifically teach the use of an ion beam in the fabrication of the gap structure.

Iwamatsu teaches that the use of ion beam etching is a known method to form a tunneling gap between electrodes (see, e.g., col. 4, lines 57 – 66). Consequently, as indicated by Iwamatsu, a person of ordinary skill in the art would deem the use of ion beam etching a suitable and predictable method to form a gap structure between two electrodes. Both of the methods disclosed by Tao and Iwamatsu, e.g., electrochemical deposition and ion beam etching, serve the

same function of facilitating the formation of a gap structure between two electrode structures that can facilitate tunneling current flow. A person of ordinary skill in the art would have recognized the suitability of substituting one known method for another in providing the predictable formation of the claimed gap structure. The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. Furthermore, the simple substitution of one known element for another is likely to be obvious when predictable results are achieved. See *KSR Int'l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007). Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of ion beam exposure to facilitate the effective formation of the claimed gap structure.

Regarding claims 7 and 8, the use of a raster or blanket ion beam application method is well known in the art. Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of a raster or blanket ion beam application technique in order to facilitate, for example, a uniform gap structure.

3. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tao in view of Kapitulnik (U.S. Pat. No. 5,219,826) ("Kapitulnik").

Regarding claim 22, the use of electron beams is a known method of fabricating tunnel gaps or barriers (see, e.g., Kapitulnik, col. 6, lines 13 – 18). Consequently, a person of ordinary skill in the art would have recognized the suitability of incorporating the use of an electron beam to form an electrode gap that can predictably facilitate the passage of a tunnel current. The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. Furthermore, the simple substitution of one known element for another is

likely to be obvious when predictable results are achieved. See *KSR Int'l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007). Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of electron beam exposure to facilitate the effective formation of the claimed gap structure.

4. Claims 26 – 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tao in view of Peters et al. (U.S. Pat. No. 5,407,868) (“Peters”).

Regarding claims 26 – 28, Tao suggests the use of an etching process (see, e.g., col. 3, lines 50 - 54). As exemplified by Peters, the use of a known etching technique, such as to provide a gap for facilitating flow of a tunneling current, is well known in the art (see, e.g., Peters, col. 1, lines 21 – col. 2, line 31). The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. Furthermore, the simple substitution of one known element for another is likely to be obvious when predictable results are achieved. See *KSR Int'l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007). Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of an etching technique to facilitate the effective formation of the claimed gap structure.

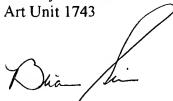
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian J. Sines whose telephone number is (571) 272-1263. The examiner can normally be reached on Monday - Friday (11 AM - 8 PM EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill A. Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Brian J. Sines
Primary Examiner
Art Unit 1743

A handwritten signature in black ink, appearing to read 'Brian J. Sines', with a large, stylized loop at the end.